CUAHSI Services to Enable Data Fusion

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CUAHSI in a Nutshell

- CUAHSI is a 501(c)3 Non-Profit Consortium of about 130 U.S. Academic Institutions, Non-Profits, and International Universities; also open to private organizations
- CUAHSI's mission is to shape the future of hydrologic science by:
  - Strengthening collaboration
  - Developing and delivering data, models, instrumentation and technologies
  - Promoting education
- Key Activities
  - **Community Services**, such as workshops, community meetings, training, etc.
  - **Data and Model Services** software to support science, including HIS and HydroShare

Community Services

Early Career Services

Resources and training to build capacity and extend capabilities

- Learn a new instrumentation method
- Engage your local community on water issues
- Develop or improve data tools
- Add a new field site to existing research
- The Summer Innovators program - contribute to the National Water Center goals
- Collaborate with researchers at other institutions

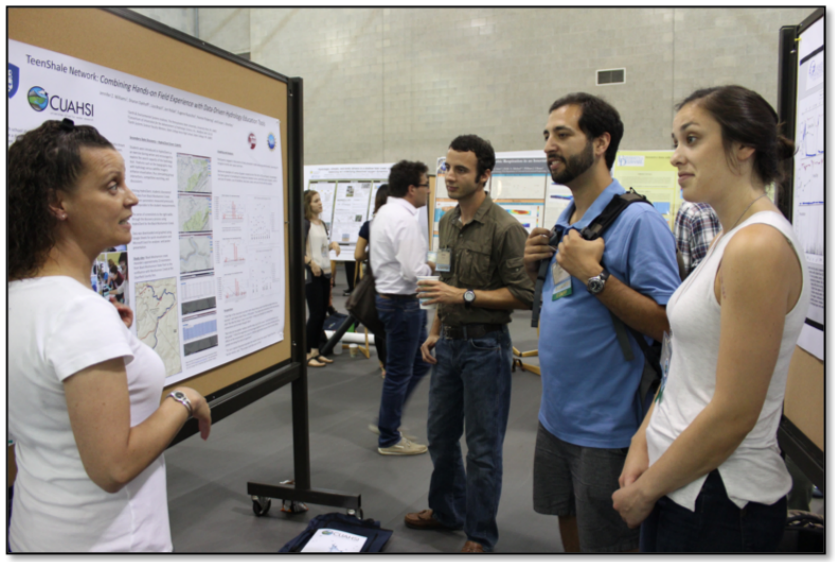




2018 CUAHSI Biennial Colloquium

July 29 – August 2 at the National Conservation Training Center in Shepherdstown, WV

- Hydrologic Connections: Climate, Food, Energy, Environment, and Society
- Workshops on drones and NASA SWOT mission
- Sessions on water and climate, hydrologic feedbacks, energy-water systems, etc.



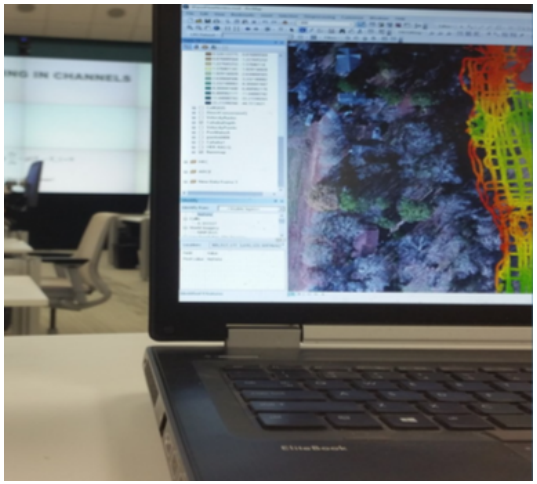
Summer Innovators Program

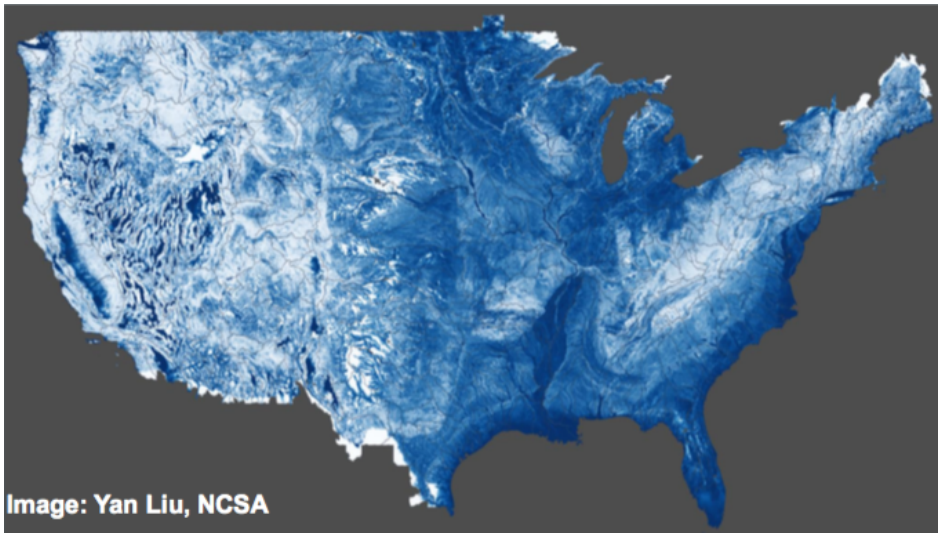
Training the next-generation of water scientists

- Partnership between CUAHSI, NWC, and the NWS
- Involvement of academic community, NCAR, DHS, US ACE, USGS
- Engages the academic research community in the enhancement of the National Water Model
- Fourth summer institute emphasis on groundwater and channel processes

Summer Innovators Program
Outcomes and broader engagement

- More than 100 students trained on NWM creating next generation of researchers and users, more than half of their advisors engaged in the process
- Advances in the NWM functionality and improved understanding of performance
- Growing engagement of academic community
- JAWRA Featured collections and CUAHSI – NOAA Technical Reports
- Transformational educational experience



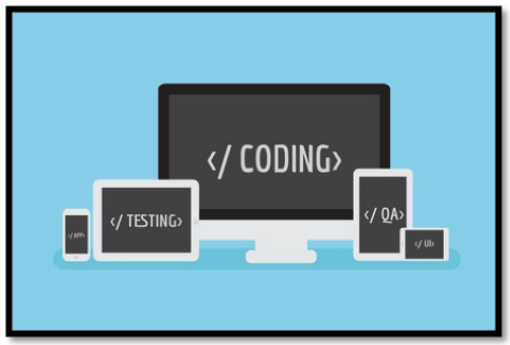


Data Services

Data Services

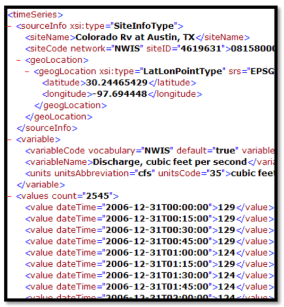
Resources to access data and models for research and education

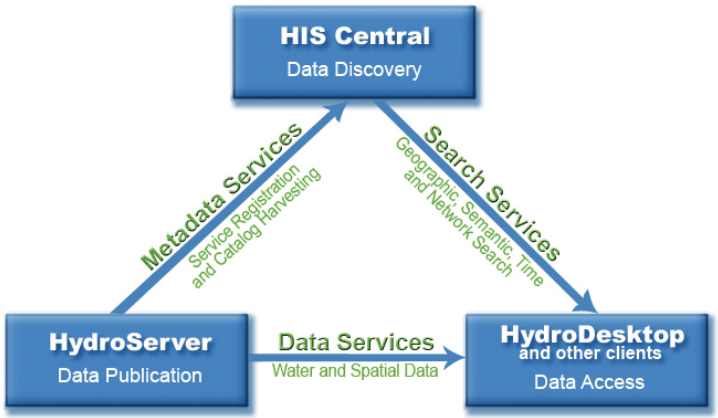
- Tools to enable science
- Share, discover, analyze, collaborate
- Free and open-source software
- Fulfill data management plans
- Research and classroom activities
- Driven by community needs

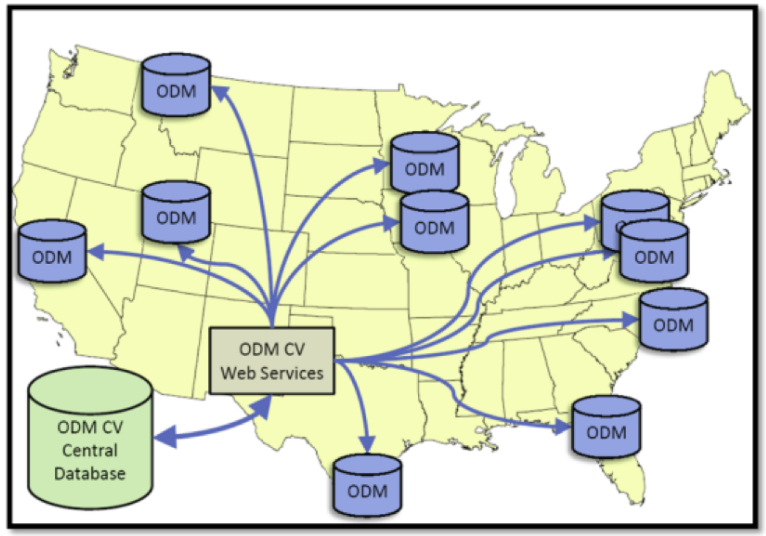


Hydrologic Information System
A general overview

- HydroSever: stores, organizes and publishes data
- HIS Central: database of metadata harvested from network
- Clients: interfaces for accessing data



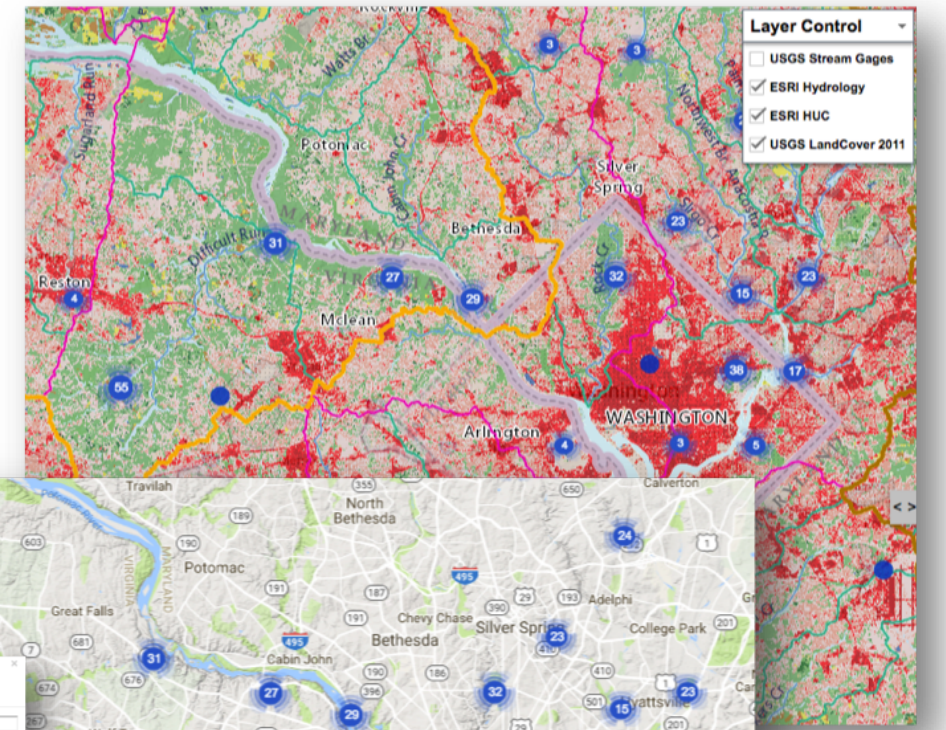


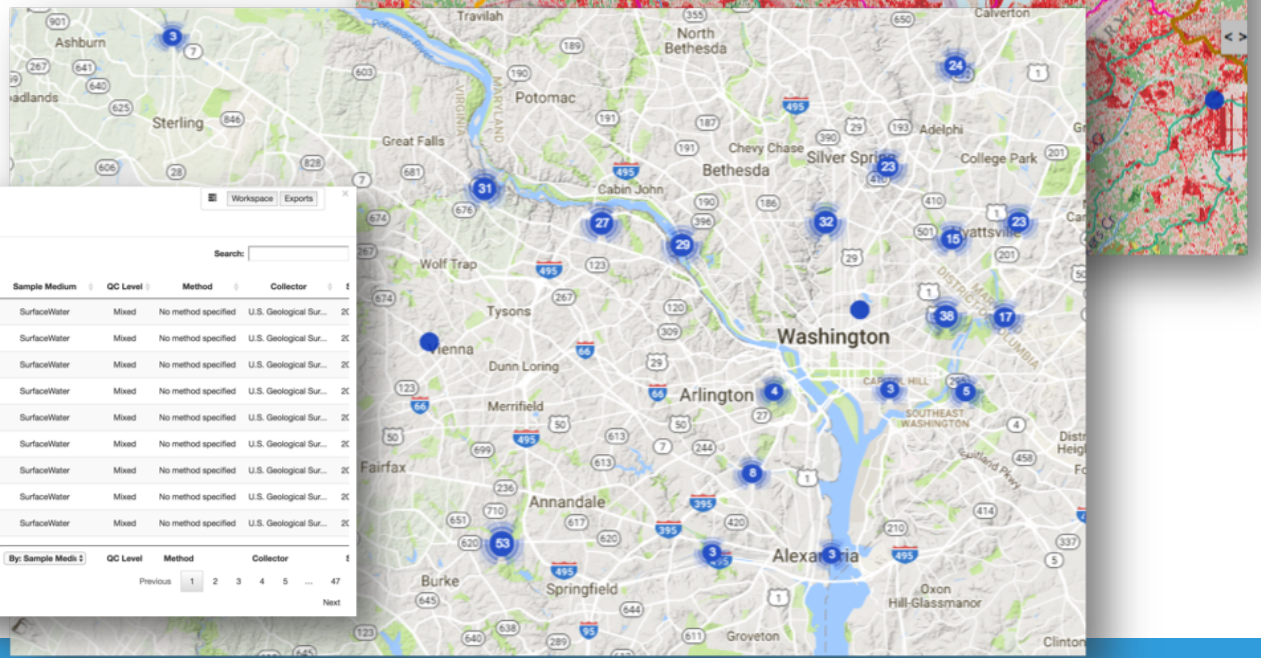


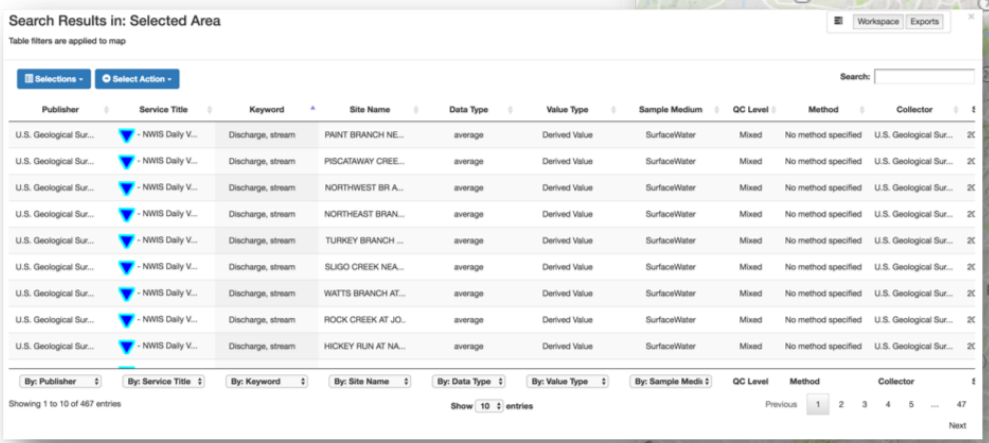
HydroClient

A CUAHSI web client for the HIS - http://data.cuahsi.org

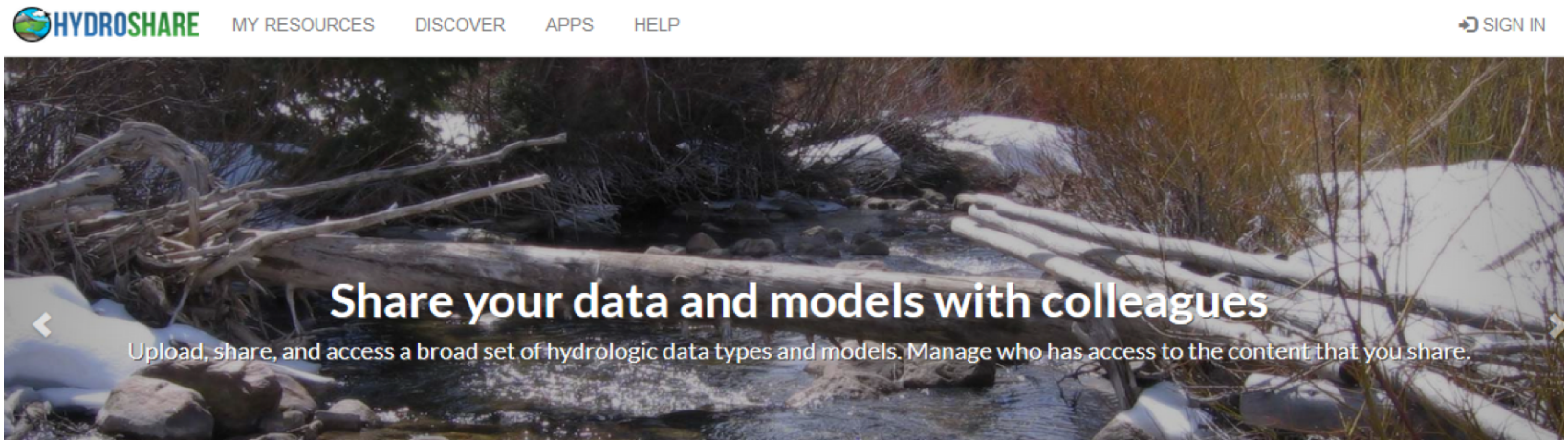
- Discover, view, download
- Federal, university, community data
- Enhancements to search and discovery interface and backend cataloging via Solr
- Integration with HydroShare Apps







HydroShare
Dealing with data disparity

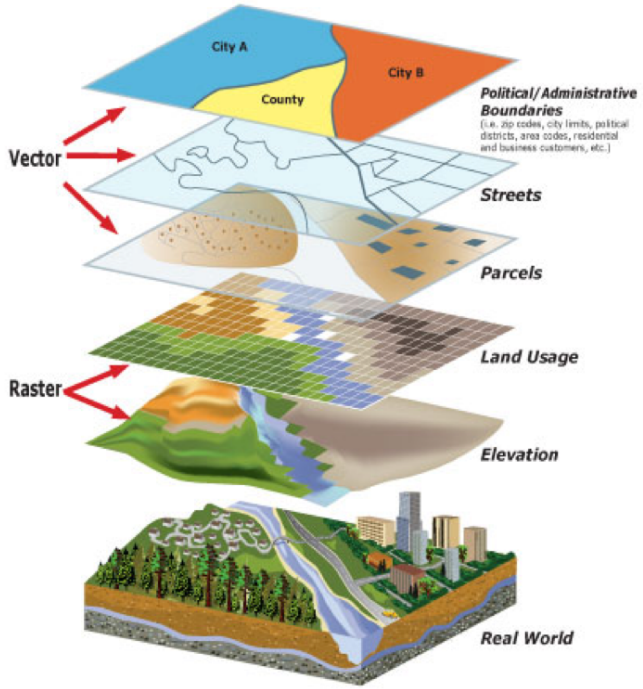


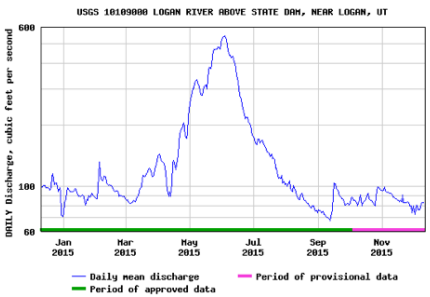
Advancing Hydrologic Understanding

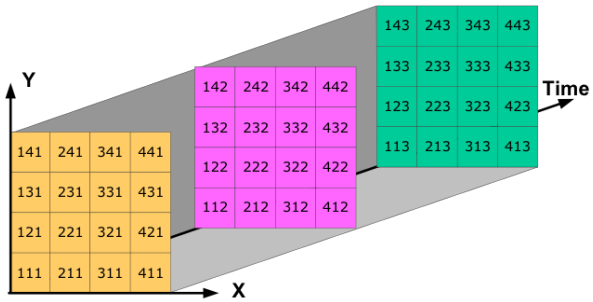
- requires integration of information from multiple sources
- may be data and computationally intensive
- requires collaboration and working as a team/community

HydroShare
Dealing with data disparity

- Time series
- Geographic raster
- Geographic feature
- Multidimensional space/time
- Model programs
- Model instances
- Combinations of the above

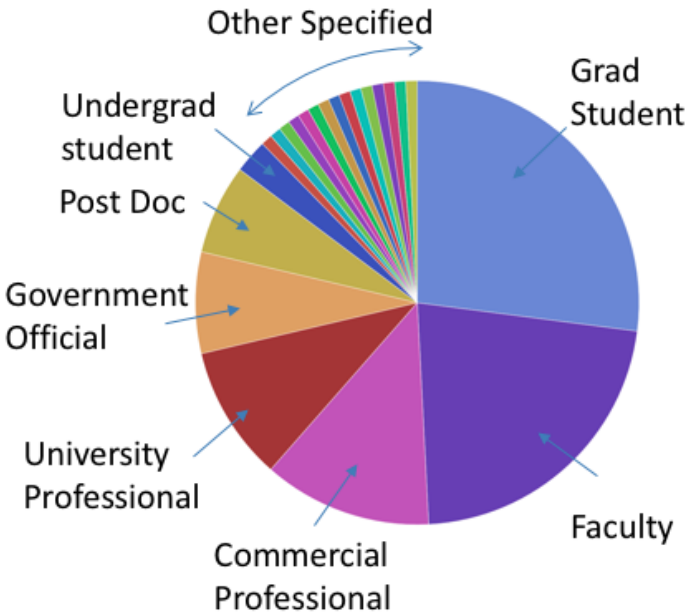




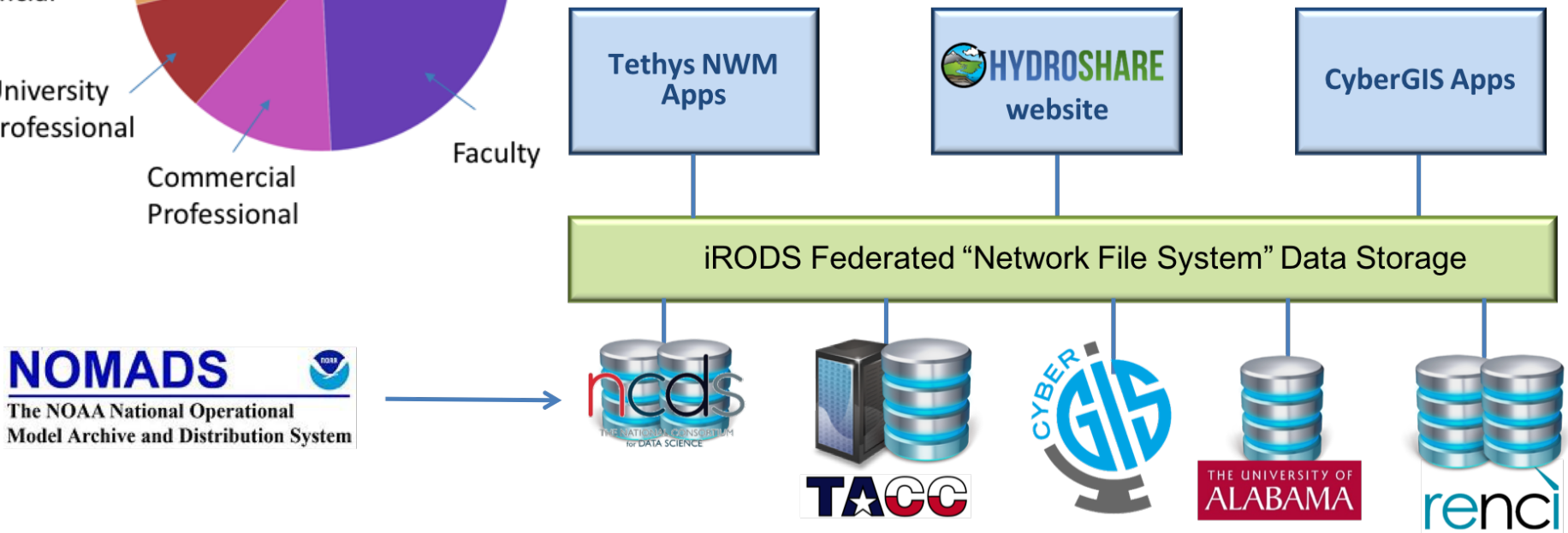


adapted from Jeff Horsburgh

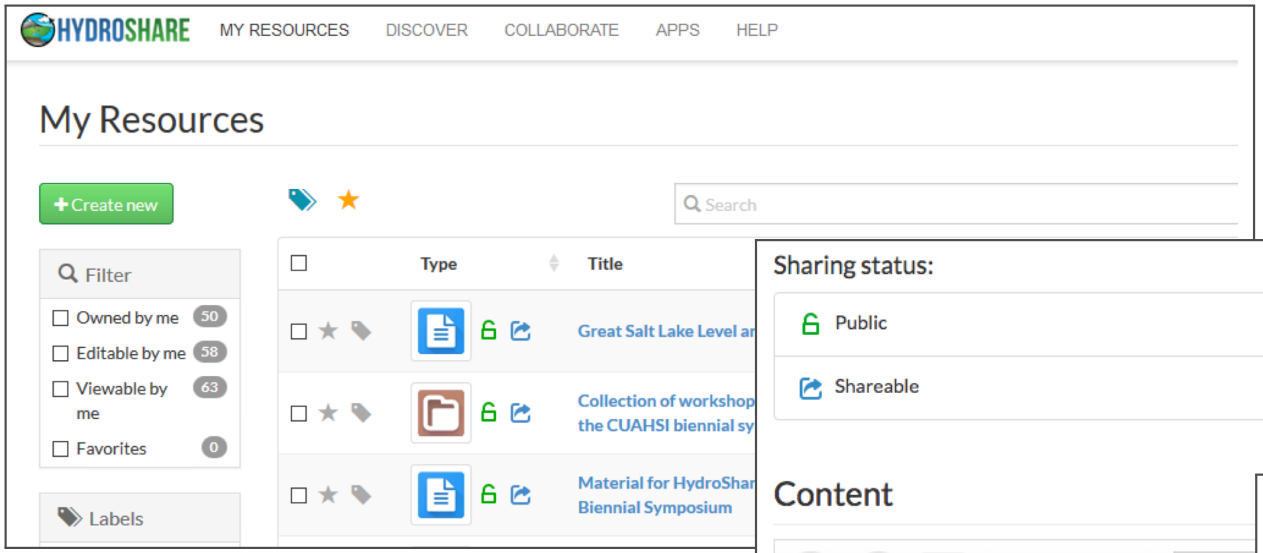
HydroShare
An architectural overview

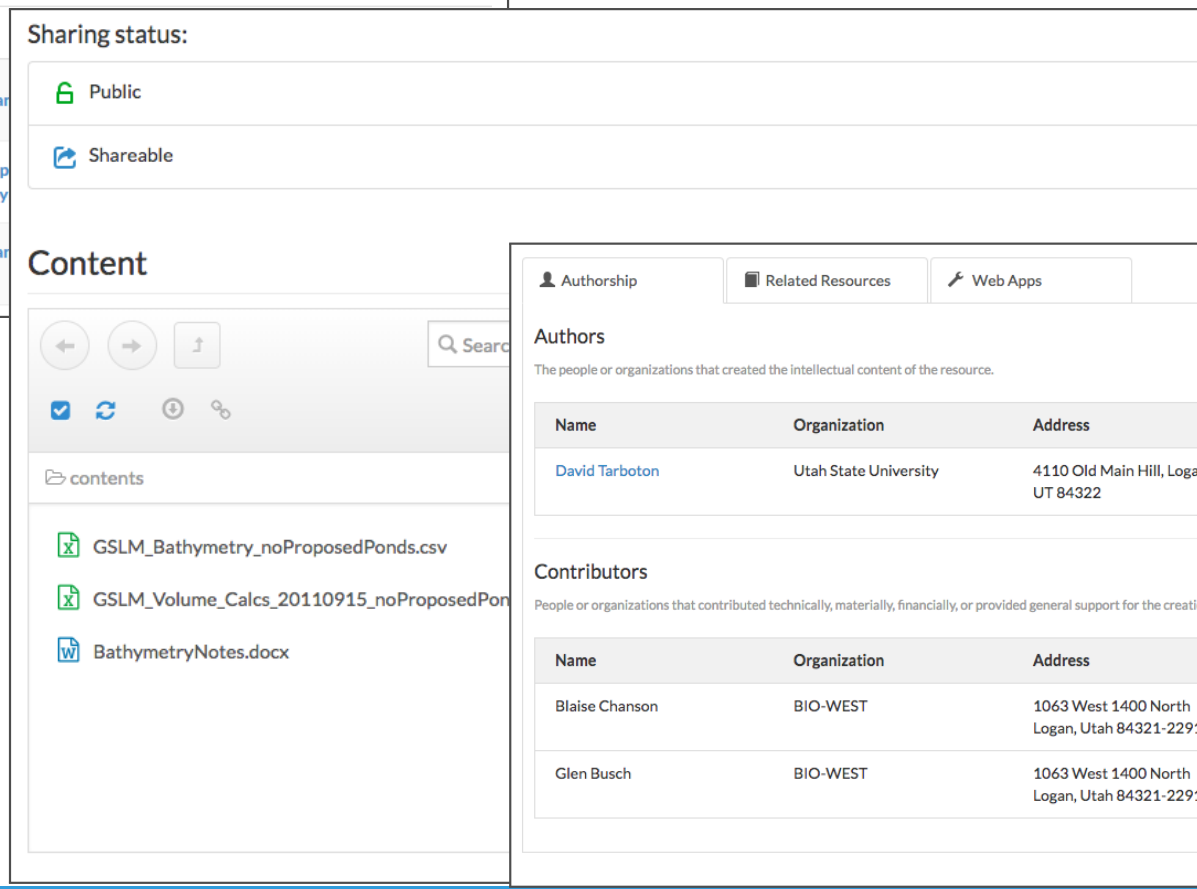


- 50 TB rolling window of NWM forcasts (2-3 TB/day)
- National HAND layer
- 50 TB store for other HydroShare data



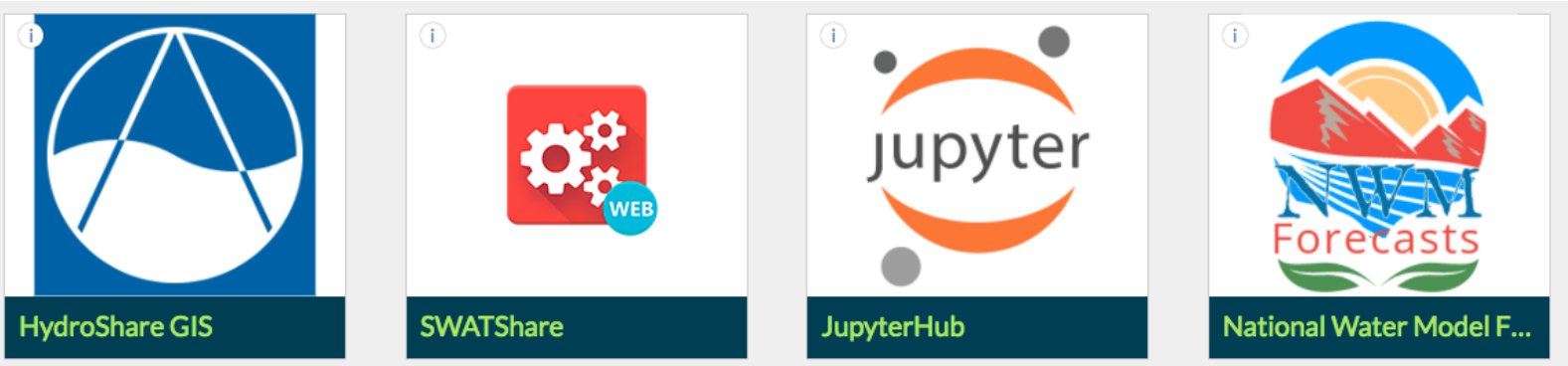
HydroShare
An overview of key functionality

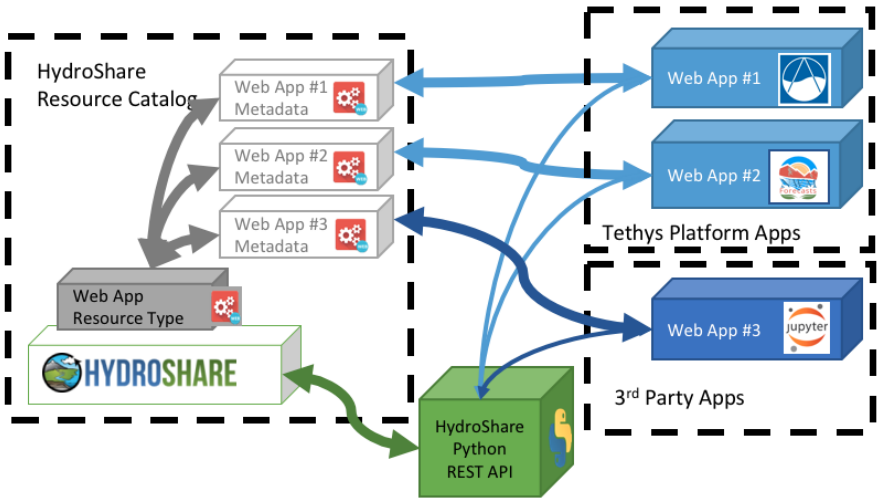




- Upload data to HydroShare
- Enhance scientific value with metadata
- Manage access and control
- Collaborate
- Publish

HydroShare
Interacting with data





OPeNDAP

Contents of /nwm/harvey/nwm.20170818/medium_range

Name	Last Modified	Size	
nwm.t00z.medium_range.channel_rt.f003.conus.nc	2017-08-18T06:13:01	3644894	de
nwm.t00z.medium_range.channel_rt.f006.conus.nc	2017-08-18T06:13:02	3623176	de
nwm.t00z.medium_range.channel_rt.f009.conus.nc	2017-08-18T06:12:52	3627995	de
nwm.t00z.medium_range.channel_rt.f012.conus.nc	2017-08-18T06:12:54	3616857	de
nwm.t00z.medium_range.channel_rt.f015.conus.nc	2017-08-18T06:12:54	3608756	de
nwm.t00z.medium_range.channel_rt.f018.conus.nc	2017-08-18T06:12:57	3595279	de
nwm.t00z.medium_range.channel_rt.f021.conus.nc	2017-08-18T06:12:54	3407687	de
nwm.t00z.medium_range.channel_rt.f024.conus.nc	2017-08-18T06:12:54	3630836	de
nwm.t00z.medium_range.channel_rt.f027.conus.nc	2017-08-18T06:13:01	3665497	de
nwm.t00z.medium_range.channel_rt.f030.conus.nc	2017-08-18T06:12:53	3654165	de
nwm.t00z.medium_range.channel_rt.f033.conus.nc	2017-08-18T06:12:46	3431127	de
nwm.t00z.medium_range.channel_rt.f036.conus.nc	2017-08-18T06:12:57	3418929	de

National Water Model Viewer
Access to daily forecasts

Home

Subset

Add Watershed

Model Configuration

Medium Range

Model Output File

Channel

Variable

Streamflow

COMID

18229909

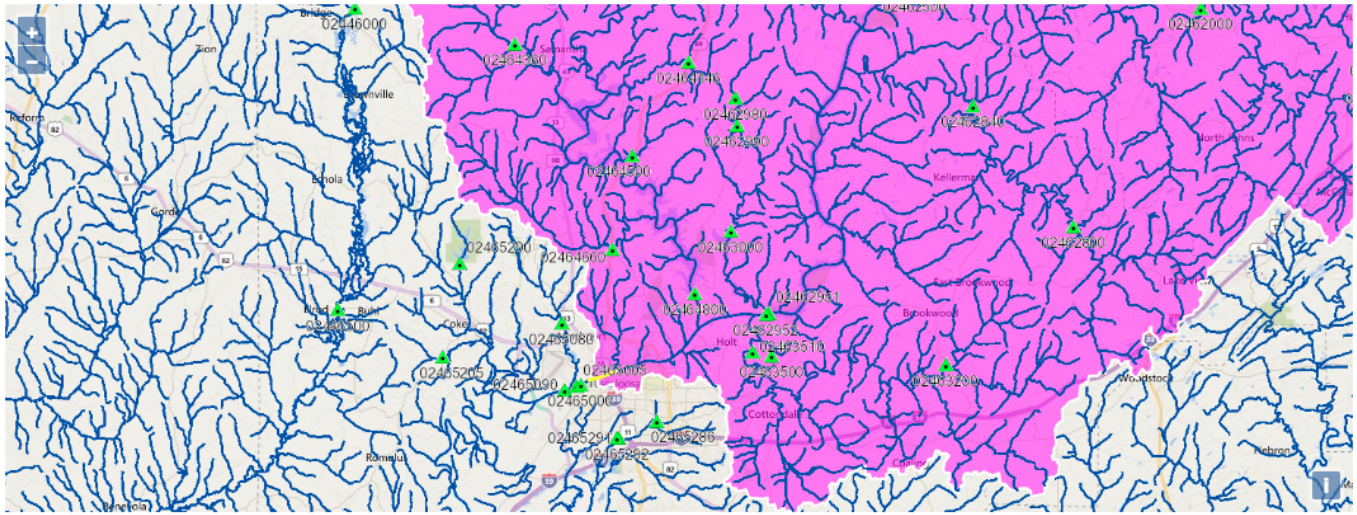
Begin Date

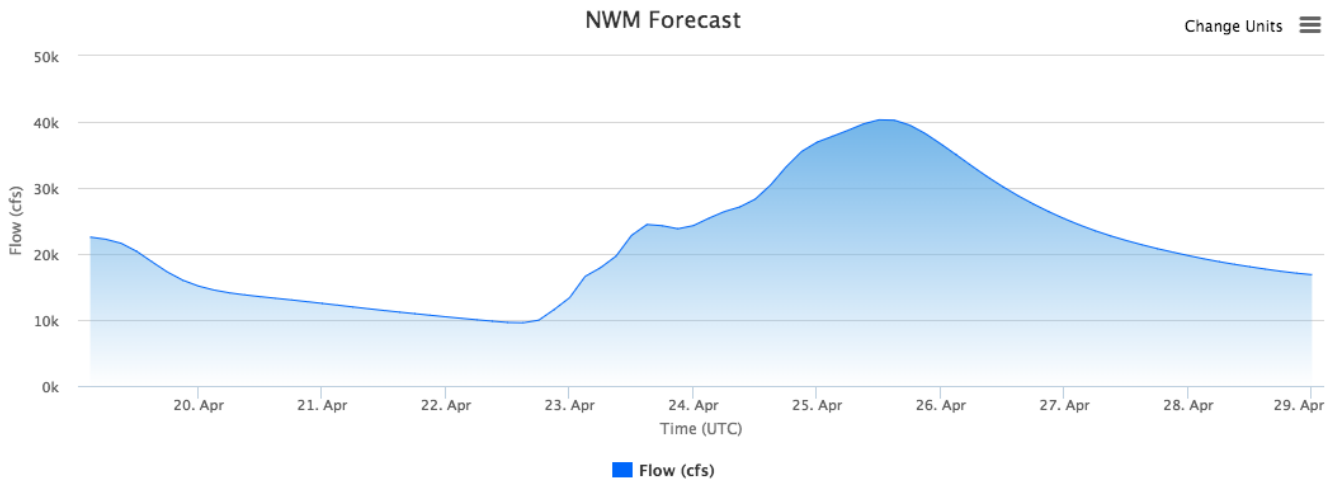
2018-04-19

Model Initialization Time (UTC)

00:00

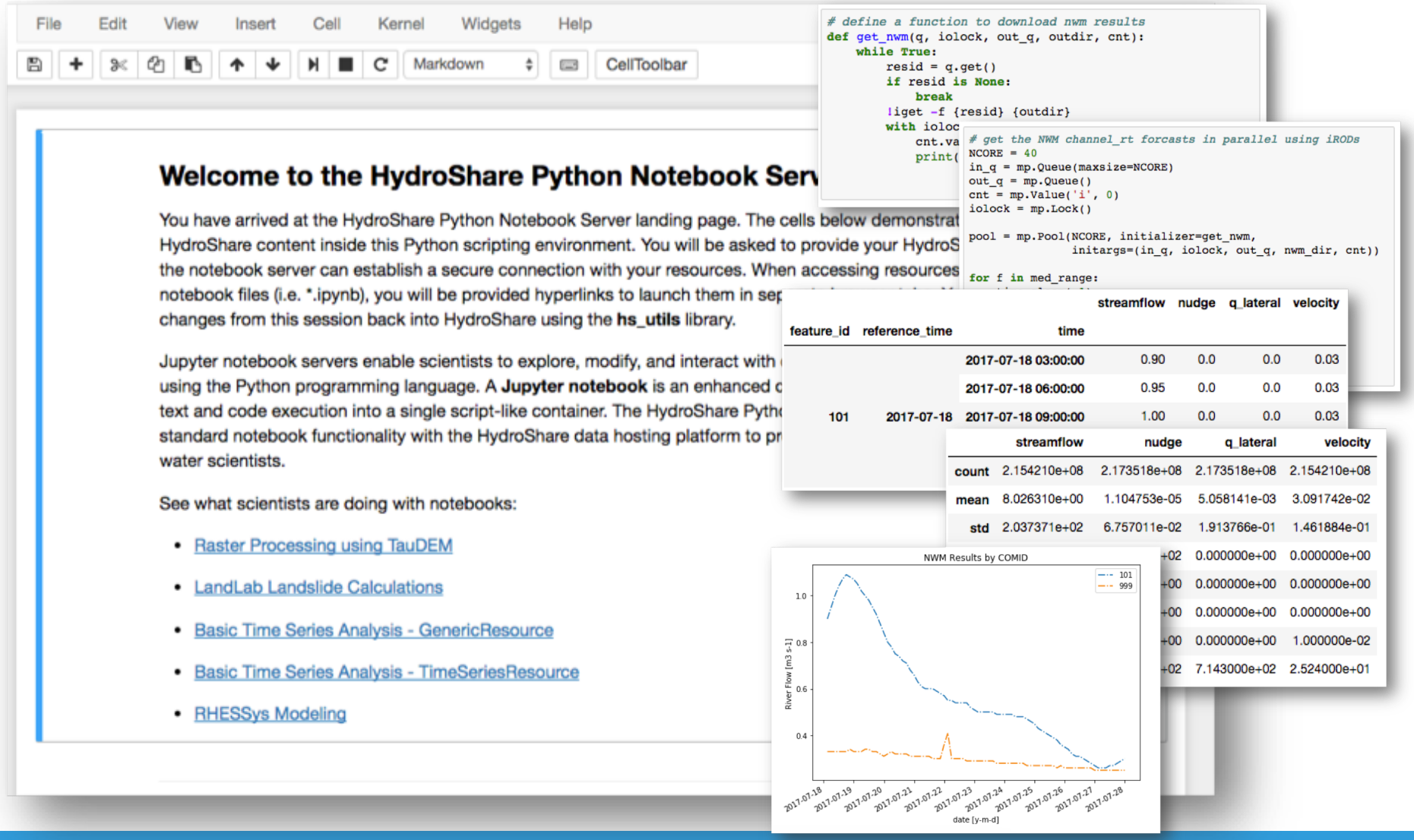
View Forecast





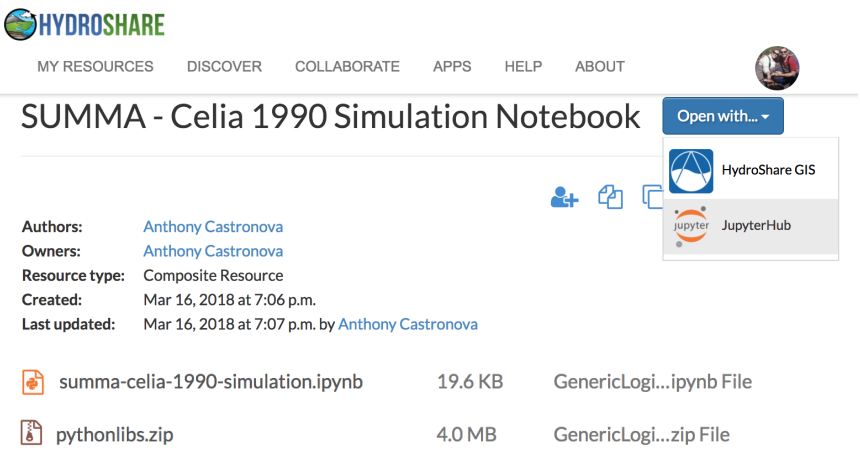
JupyterHub

A cloud-based coding environment - https://jupyter.cuahsi.org/



JupyterHub
Supporting scientific reproducibility

- Reproducible Science
- Scientific Collaboration
- Education
- Computationally Intensive Research
- Data Intensive Research



Import Libraries and Prepare Environment

In [1]:
```
import os, sys

# unzip the python libraries
!unzip -oq pythonlibs.zip

# add our libs directory to the path
sys.path.append('./pythonlibs')
sys.path.append('./pythonlibs/lib/python3.6/site-packages')
sys.path.append('./pythonlibs/bin')
```

In [2]:
```
#import celeryworker as c
from pysumma.Simulation import Simulation
from hydroshare import hydroshare
```

Collect Input Data from HydroShare

- Connect to HydroShare
- Download simulation input data

In [3]:
```
hs = hydroshare.hydroshare()
```
```
Please enter your HydroShare username: TonyCastronova
Enter the HydroShare password for user 'TonyCastronova': ••••••••
Successfully established a connection with HydroShare
```

In [4]:
```
hs.getResourceFromHydroShare('6686dc8f26ac4bce8ff4c11e5953a74c')
```
```
Download Finished
Successfully downloaded resource 6686dc8f26ac4bce8ff4c11e5953a74c
```

Found the following file(s) associated with this HydroShare resource.

celia-simulation.zip

These files are stored in a dictionary called **hs.content** for your convenience. To access a file, simply issue the following command where MY_FILE is one of the files listed above:

```
hs.content["MY_FILE"]
```

Look at the content of the HydroShare resource that was downloaded

In [5]:
```
print(hs.content)
data_archive = hs.content['celia-simulation.zip']
```

Meeting the Needs of the Community

- CUAHSI is model agnostic
- Provide community tools such as HIS and HydroShare, along with documentation and API's
- Provide community data sets for selected use cases through CUAHSI Water Data Services. (Harvey/Irma and Maria RAPID awards)
- Continue with Summer Institute and potentially similar activities
- Organize and host community meetings

Thank You

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